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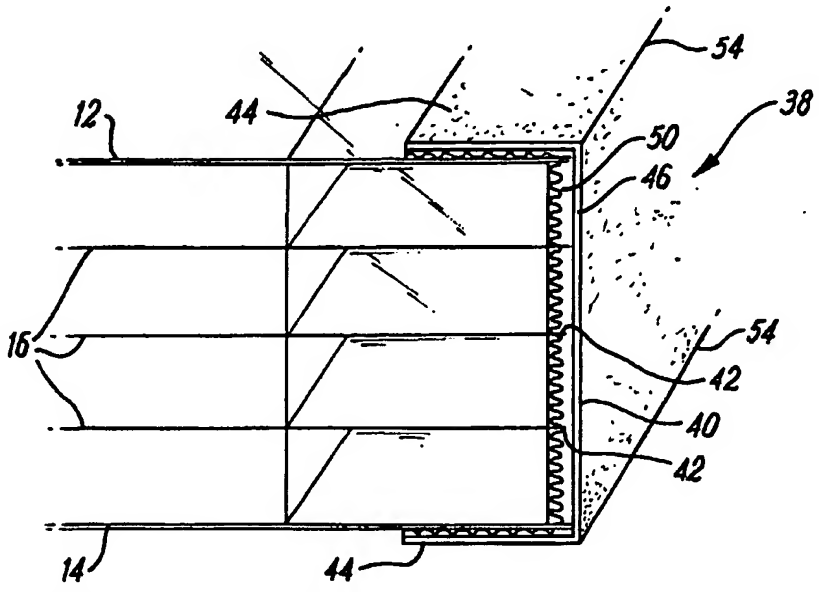
(54) Title: SEALING APPARATUS AND METHOD



(57) Abstract: A sealing tape (8) for sealing an open end (42) of a multiwall sheet structure includes a layer (48) of thermoplastics material, such as polyamide or vinyl, having a profiled surface comprising projections (52) and valleys, channels or troughs. The profiled surface is locatable over the open end (42) of the structure and is heat softened so that the ends of components of the structure can embed into the thermoplastics material and be supported thereby when solidified. The profiled surface may include a plurality of projections, which projections may be of a generally domed shape or may be elongate and extend longitudinally. Methods of forming the sealing tape and sealing an open end of a multiwall sheet structure using the tape are also described.

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Sealing Apparatus and Method

This invention concerns sealing apparatus, and in particular a tape, for sealing an open end of a multiwall sheet structure, a method of making such a tape, and also a method of sealing an open end of a multiwall sheet structure.

Multiwall sheeting is commonly used as a roofing material for conservatories, awnings, car ports etc. or in walling or as a partition. Such sheeting is often made of polycarbonate. The popularity of such material is increasing such that new forms are constantly being developed along with new uses for this material. Such sheeting can be manufactured in a wide variety of formats. A problem with such a sealing arrangement is that the edge of such sheets tend to be relatively weak as the internal walls, webs or other structures are not supported at the edge. These edges can be particularly important as they are intended to mount the various components such as glazing bars or edging clips, which components require a firm edge for satisfactory mounting.

A further problem with such sheets is that without effective protection they are liable over a period of time to suffer from a variety of problems. The principle difficulties are those of internal condensation, and the ingress of dust and spores, which can cause unsightly mould growths, dirt and water marks. Due to the cellular structure of the sheeting, the internal cavities generally cannot be cleaned and the consequent degrading of the sheets is unacceptable and would necessitate removal and refitting.

Conventionally the open ends of such sheeting have been sealed by foils or tapes. Such seals can become damaged during transit. Furthermore, cut sheets often have extremely sharp edges which can cut such seals. In using such methods wholly effective seals are not always obtained, and particularly as the top and bottoms of such sheets are often not wholly planar, tending to narrow at junctions with cross-webs, and bow out at the mid-points between cross-webs.

The term "multiwall sheet structure" when used hereinafter is to be understood as meaning an open structure comprising at least upper and lower planar sheets, which are connected by a number of webs and/or other arrangements, usually of the same material. Such structures may be made of a number of spaced sheets with interconnecting arrangements.

According to the present invention there is provided a tape for sealing an open end of a multiwall sheet structure, the tape comprising a layer of a thermoplastics material, the layer having a profiled surface comprising projections, and valleys, channels or troughs, the profiled surface being locatable over said structure end when said profiled surface is at least heat softened such that the ends of components of the structure can embed into the thermoplastics material and be supported thereby when solidified.

The profiled surface may comprise a plurality of projections upstanding from an at least a generally uniform thickness layer. The projections may have a generally domed shape, and may extend for between 0.5 mm and 4 mm from the layer, and desirably around 2 mm.

Alternatively the projections may be elongate and may extend longitudinally. The projections may be configured to define elongate channels therebetween, which channels may increase in width downwardly and which channels may have a dovetail cross-section. The tape may comprise an extruded length of material, with the profiled surface formed by the extrusion.

The projections may include subsidiary projections extending therefrom. The profiled surface may include subsidiary projections extending upwardly from the profiled surface to facilitate the ends of components becoming embedded in the thermoplastics material. Preferably the subsidiary projections are elongate and/or extend longitudinally.

The thermoplastics material may comprise a polyamide or vinyl. The tape may comprise a backing layer, which layer may comprise vinyl or polycarbonate.

The profiled surface may extend substantially across the whole width of the tape.

Alternatively, the tape may comprise a mid-portion locatable over the end of the sheet structure and side portions locatable respectively over the side walls of the sheet structure adjacent said end, at least the mid-portion being provided with said thermoplastics layer.

A profiled surface may also be provided on the side portions of the tape. A thicker profiled surface may be provided on the mid-portion.

A support structure may be provided in at least the thermoplastics material layer. The support structure may be in the form of a grid of material. The projections in the profiled surface may correspond to the openings in the grid, with the valleys or troughs corresponding to the linear members of the grid.

The material of the grid preferably has a higher melting point than that of the thermoplastics material. The grid material may comprise any of glass fibre, cotton, or a metal, for instance copper or stainless steel.

The invention also provides a method of forming a tape according to any of the preceding ten paragraphs, the method comprising forming a layer of thermoplastics material, and subsequently forming a profiled surface thereon.

The profiled surface may be formed using a profiled roller. Alternatively, the profiled surface may be formed by cutting an outer surface of the thermoplastics material layer in two or more directions.

As a further alternative the profiled surface may be formed by pushing the support structure into the thermoplastics layer whilst the latter is not wholly solid.

A sheet of material may be formed, and a plurality of lengths of tape

subsequently cut therefrom.

The invention further provides a method of sealing an open end of a multiwall sheet structure, the method comprising using a tape according to any of said preceding ten paragraphs, at least heat softening the profiled surface of the thermoplastics material layer of the mid-portion, and locating said mid-portion over the sheet structure end such that components of the structure embed into the thermoplastics material.

Where the tape includes subsidiary projections, the method may include an additional step whereby the subsidiary projections are initially softened to facilitate the ends of components becoming embedded in the thermoplastics material.

When the profiled surface of the mid-portion is at least softened, at least a rear part of the thermoplastics material of the mid-portion preferably remains substantially solid. The rear part may be cooled to maintain said part solid.

A molten thermoplastics material may be applied onto the profiled surface of the mid-portion prior to application on the sheet structure end, and the heat of the molten thermoplastics material preferably causes the at least softening of the profiled surface.

The molten thermoplastics material is preferably applied substantially immediately before the mid-portion is applied onto the sheet structure end. The tape is preferably applied to the sheet structure with the latter inclined from the horizontal. Following application of the mid-portion onto the structure end, the side portions are preferably mounted on the side walls of the sheet structure.

A molten thermoplastics material may be applied onto the sides of the sheet structure adjacent the end thereof, such that the thermoplastics material overlaps onto the rear of the mid-portion.

The side portions may be mounted by at least softening, and preferably melting, thermoplastics material provided thereon. Heat may be applied to the respective parts of the backing layer.

Alternatively, the side portions are mounted by providing silicone thereon, which may be transparent and/or may be applied as a bead of material to bond to the sheet structure. Heat may be applied to accelerate cure of the silicone.

The tape may be folded or creased between the mid and side portions prior to application onto the sheet structure end. The side portions may be urged onto the side walls of the sheet structure by rollers.

Embodiments of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:-

Figs. 1 to 3 are perspective views of different multiwall sheet structures;

Fig. 4 is a plan view of a multiwall sheet structure illustrating how sheet structure components could be cut therefrom;

Fig. 5 is a perspective view of a sheet structure component cut from the sheet of Fig. 4;

Fig. 6 is a perspective view of a sheet structure component cut from a further sheet;

Fig. 7 is a diagrammatic perspective view of part of a first tape according to the present invention;

Fig. 8 is a diagrammatic perspective view of the tape of Fig. 7 being used to seal an end of a multiwall sheet structure;

Fig. 9 is a diagrammatic perspective view of a sheet end and side wall sealed by tapes as shown in Fig. 7;

Fig. 10 is a diagrammatic perspective view of part of a second tape according to the present invention;

Fig. 11 is a diagrammatic cross-sectional view through part of the second tape;

Figs. 12 and 13 are similar views perspectively to Figs. 10 and 11 but of a third tape according to the present invention;

Fig. 14 is a cross-sectional end view of the third tape being used to seal an end of a multiwall sheet structure;

Fig. 15 is a part cross-sectional end view of an alternative version of the third tape including subsidiary projections; and

Fig. 16 is a cross-sectional end view of the tape of Fig. 15 being used to seal an end of a multiwall sheet structure.

Figs. 1 to 3 show different multiwall sheet structures which could typically be used as roofing for conservatories or other applications, or for use as partitions. Conventionally such structures would be made of polycarbonate, but other materials may be applicable. Fig. 1 shows a simple structure 10 comprising upper and lower sheets 12, 14, with two equispaced mid-sheets 16 separated by perpendicular cross-webs 18.

Fig. 2 shows a more complex structure 20 with a generally similar arrangement but more mid-sheets 16. Fig. 3 shows a still more complex structure 22 where in addition to the webs 18 there are provided further diagonal webs 24.

Fig. 4 shows a multiwall sheet 26 from which two triangular sheet structure components 28 and two rectangular components 30 could be cut. Fig. 5 shows one of the triangular components 28 illustrating how at various points, and particularly the apices 32 the upper and lower sheets 12, 14 and mid-sheet 16 are unsupported for a significant distance. Fig. 6 shows a further sheet structure rectangular component 34 illustrating how the upper and lower sheets 12, 14 and mid-sheet 16 are quite unsupported along the side edges 36.

Figs. 7 to 9 illustrate a first tape 38 suitable for sealing such edges 36 and providing support to the upper and lower sheets 12, 14 and mid-sheets 16 thereat. The tape 38 comprises a mid-portion 40 locatable over the ends of the sheet structure 42 as shown in Figs. 8 and 9, and two side portions 44 locatable respectively on the upper and lower sheets 12, 14 of the structure 42. Fig. 9 illustrates two tapes 38 having been applied respectively to perpendicular side edges 36.

The tape 38 is formed from a layer of vinyl 46 upon which a layer 48 of a thermoplastics material such as a polyamide is provided. The layer 48 comprises a substantially constant thickness first part 50 from which upwardly extend a plurality of spaced domed projections 52. In this instance the projections 52 extend for around 2 mm. Creases 54 are provided between the mid-portion 40 and side portions 44.

The profiled surface of the thermoplastics material on the sheet may be formed by a profiled roller. Alternatively, the profiled surface could be formed by cutting into the thermoplastics material in at least two directions. In some instances it may be appropriate to cool the exterior of the backing tape over the mid-portion 40 during mounting on the structures to ensure that the whole of the thermoplastics material thereon does not melt.

In use, the tape 38 is applied onto the structure 42 in the following manner. With the structure 42 in position at an angle of typically 30° to the horizontal, molten thermoplastics material, and desirably a similar polyamide, is applied to just the inner face of the mid-portion 40 which causes the projections 52 to tend to become semi-molten whilst the first part 50 remains substantially solid. The mid-portion 40 is then located on the sheet end 42. The upper and lower sheets 12, 14 and mid-sheets 16 become embedded in the mid-portion 40 until the substantially solid part 50 is reached.

Heat is subsequently applied to the backing tape 46 of the side portions 44, causing the thermoplastics material layer 48 thereon to melt. The side portions 44 are urged against respectively the upper and lower sheets 12, 14 and held thereon by pressure rollers until the thermoplastics material has solidified and provided a bond therebetween.

The seal to the sheet structure end provides the equivalent of an additional cross-web thereby providing structural integrity to the end. The use of the molten thermoplastics material and also the contoured tape permits the molten material to be held on the tape by the contours, and the ends of the upper and lower sheets 12, 14 and mid-sheets 16 to be softly received in the

thermoplastics material and subsequently supported thereby. In practice the projections 52 will become intermixed with the initially molten layer, but are shown diagrammatically in Fig. 8.

Figs. 10 and 11 show a second tape 60 usable in similar applications to those outlined for the tape 38. The tape 60 does not have side portions but rather just comprises a profiled portion locatable across the end of multiwall sheeting to close same. The tape 60 is formed from a thermoplastics material which is profiled to provide a number of projections 62 divided by valleys 64. A support structure 66 is provided within the thermoplastics material of the tape 60. The structure 66 is in the form of an open mesh glass fibre grid. The openings in the grid of the structure 66 correspond to the projections 62 and the linear members of the grid correspond to the valleys 64.

The tape 60 can be made in the following manner. A layer of molten thermoplastics material is formed onto a backing paper. The backing paper is caused to roll onto a chilled roller, and as this takes place a glass fibre mesh is pushed onto the thermoplastics material such that the mesh is substantially wholly enveloped in the thermoplastics material. The effect of the cooling roller and the mesh causes the profiled formation of the tape 60 with the projections 62 and valleys 64 to be formed. Once the thermoplastics material is solid the backing paper is removed during unwinding, and the material cut into appropriate widths to form tapes 60.

The tape 60 can be applied to the open end of a multiwall sheet structure as follows. The tape 60 is heated to cause it to soften and a layer of molten thermoplastics material is applied to the profiled surface of the tape 60. The coated tape can then be located against the multiwall structure such that the ends of the sheet become embedded into the profiled surface, to provide a waterproof and also supported end closure to the sheet.

The tape 60 may be applied onto the structure as the latter passes through a shallow trough. A bead of molten thermoplastics material may be applied to each side of the structure adjacent the end, such that the

thermoplastics material spreads out to overlap onto the rear of the tape 60 to enhance the seal between the edges of the tape 60, and the structure.

The support structure provides structural integrity to the tape. This is particularly important when the tape is softened during application and also for instance during use at high temperatures. The support structure prevents the tape from stretching or slumping.

A wide range of materials could be used for the support structure and it is important that its melting point is higher than that of the thermoplastics material such that integrity is maintained when the tape is softened. Suitable alternative materials may comprise cotton or a metal such as copper or stainless steel. Whilst this tape is described without side portions, it may be that a wider tape could be provided beneath the thermoplastics layer which closes the sheeting, and this wider tape could be applied following application of the tape 60 to sheeting.

Figs. 12 to 14 show a third tape 70 again usable in similar applications to those outlined above. The tape 70 is formed from an extrusion of thermoplastics vinyl material. The extrusion has a flat underside 72 and a top side 74 with a plurality of equi-sized parallel elongate projections 76. The projections 76 have a dovetail cross-section which converges downwardly. A plurality of channels 78 are defined between the projections 76, which channels 78 also have a dovetail cross-section, but converge upwardly. The tape 70 has side edges 80 which extend upwardly a short distance beyond the top of the projections 76.

Fig. 14 shows the tape 70 in use sealing an edge 82 of a multiwall sheet structure 84. The tape 70 is applied to the edge 82 as follows. A molten thermoplastics material 86 is applied onto the tape 70 and is generally held thereon by the side edges 80 and also the channels 78 and particularly their dovetail cross-section. The molten material 86 causes the upper surface of the tape 70 and particularly the upper surface of the projections 76 to soften such that the edge 82 embeds therein. As the material 86 solidifies this bonds the

tape 70 onto the edge 82 to provide a good seal therearound. The flat underside 72 and outer faces of the side edges 80 provide a smooth exterior to the sealed edge 82. The side edges 80 and shape of the channels 78 have been found to be advantageous in retaining the molten material 86 thereon before and as the structure 84 is placed thereon.

Figs. 15 and 16 show an alternative version 190 of the third tape 70 in which elongate subsidiary projections 192 extend from base projections 176. The subsidiary projections 192 comprise thermoplastics material and can be formed integrally with the projections 176 during extrusion of the tape 190. Creases 194 are also provided between the mid portion and side portions of the tape 190. The subsidiary projections 192 are fine and small relative to the base projections 176 and their distribution on the base projections 176 may be chosen to correspond to the arrangement of components of a particular multiwall sheet structure.

Fig. 16 shows the tape 190 in use sealing an edge 182 of a multiwall sheet structure 184. The tape 190 is applied to the edge 182 in the same manner as the tape 70 already set forth. However, upon the application of molten thermoplastics material 186, the subsidiary projections 192 are initially softened to facilitate embedding and location of the edge 182 in the thermoplastics material 186. The fine and small nature of the subsidiary projections 192 allows them to melt quickly and assist in the secure location of the tape by providing a surface in which the edge 182 can initially embed. As the material 186 and subsidiary projections 192 resolidify, the tape 190 becomes securely bonded to the edge 82 to provide a good seal therearound.

The invention thus permits cut ends of multiwall sheet structures to be effectively closed and sealed wherever cut. This provides for sealing of the sheet structure and structural integrity at the ends to allow for mounting thereof.

Various other modifications may be made without departing from the scope of the invention. For instance, in some applications it may be possible to

not apply the molten plastics material, and rather to at least soften the profiled portion by heating. Where the tape has side portions it may be that a profiled structure is only required for the mid-portion of the tape, or a greater thickness of profiled material may be provided on the mid-portion. Different materials may be used other than those described above.

In a further alternative arrangement, the side portions of the tape can be bonded onto respectively the upper and lower sheets, by applying a fine bead of transparent silicone onto the side portions, and subsequently applying heat and pressure.

It is to be realised that tapes according to the invention will be dimensioned according to the sheet structure they are intended to be used with. In practice the tapes can be made from a single sheet cut to appropriate widths.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims

1. A tape for sealing an open end of a multiwall sheet structure, the tape comprising a layer of a thermoplastics material, the layer having a profiled surface comprising projections, and valleys, channels or troughs, the profiled surface being locatable over said structure end when said profiled surface is at least heat softened such that the ends of components of the structure can embed into the thermoplastics material and be supported thereby when solidified.

2. A tape according to claim 1, wherein the profiled surface comprises a plurality of projections upstanding from an at least a generally uniform thickness layer.

3. A tape according to claim 1 or claim 2, wherein the projections have a generally domed shape.

4. A tape according to any of the preceding claims, wherein the projections extend for between 0.5 mm and 4 mm from the layer.

5. A tape according to claim 4, wherein the projections extend for around 2 mm.

6. A tape according to any of the preceding claims, wherein the projections are elongate.

7. A tape according to any of the preceding claims, wherein the projections extend longitudinally.

8. A tape according to any of the preceding claims, wherein the projections are configured to define channels therebetween.

9. A tape according to claim 8, wherein the channels increase in width downwardly.

10. A tape according to claim 9, wherein the channels have a dovetail cross-section.

11. A tape according to any of the preceding claims, wherein the tape comprises an extruded length of material, with the profiled surface formed by the extrusion.

12. A tape according to any of the preceding claims, wherein the projections include subsidiary projections extending therefrom.

13. A tape according to any of the preceding claims, wherein the profiled surface includes subsidiary projections extending upwardly from the profiled surface to facilitate the ends of components becoming embedded in the thermoplastics material.

14. A tape according to claim 12 or claim 13, wherein the subsidiary projections are elongate and/or extend longitudinally.

15. A tape according to any of the preceding claims, wherein the thermoplastics material comprises a polyamide or vinyl.

16. A tape according to any of the preceding claims, wherein the tape comprises a backing layer.

17. A tape according to claim 16, wherein the layer comprises vinyl or polycarbonate.

18. A tape according to any of the preceding claims, wherein the profiled surface extends substantially across the whole width of the tape.

19. A tape according to any of the preceding claims, wherein the tape comprises a mid-portion locatable over the end of the sheet structure and side portions locatable respectively over the side walls of the sheet structure adjacent said

end, at least the mid-portion being provided with said thermoplastics layer.

20. A tape according to claim 19, wherein a profiled surface is provided on the side portions of the tape.

21. A tape according to claim 20, wherein the mid-portion of the tape has a profiled surface which is thicker than the side portions.

22. A tape according to any of the preceding claims, wherein a support structure is provided in at least the thermoplastics material layer.

23. A tape according to claim 22, wherein the support structure is in the form of a grid of material.

24. A tape according to claim 23, wherein the projections in the profiled surface correspond to the openings in the grid, with the valleys or troughs corresponding to the linear members of the grid.

25. A tape according to claim 23 or claim 24, wherein the material of the grid has a higher melting point than that of the thermoplastics material.

26. A tape according to any of claims 23 to 25, wherein the grid material comprises any of glass fibre, cotton, or a metal, for instance copper or stainless steel.

27. A method of forming a tape according to any of the preceding claims, the method comprising forming a layer of thermoplastics material, and subsequently forming a profiled surface thereon.

28. A method of forming a tape according to claim 27, wherein the profiled surface is formed using a profiled roller.

29. A method of forming a tape according to claim 27, wherein the profiled surface is formed by cutting an outer surface of the thermoplastics material

layer in two or more directions.

30. A method of forming a tape according to claim 27, when dependent on any of claims 22 to 26, wherein the profiled surface is formed by pushing the support structure into the thermoplastics layer.

31. A method of forming a tape according to any of claims 27 to 30, wherein a sheet of material is formed, and a plurality of lengths of tape subsequently cut therefrom.

32. A method of sealing an open end of a multiwall sheet structure, the method comprising using a tape according to any of claims 19 to 26, at least heat softening the profiled surface of the thermoplastics material layer of the mid-portion, and locating said mid-portion over the sheet structure end such that components of the structure embed into the thermoplastics material.

33. A method according to claim 32, wherein, where the tape includes subsidiary projections, the method includes an additional step whereby the subsidiary projections are initially softened to facilitate the ends of components becoming embedded in the thermoplastics material.

34. A method according to claim 32 or claim 33, wherein when the profiled surface of the mid-portion is at least softened, at least a rear part of the thermoplastics material of the mid-portion remains substantially solid.

35. A method according to claim 34, wherein the rear part is cooled to maintain said part solid.

36. A method according to any of claims 32 to 35, wherein a molten thermoplastics material is applied onto the profiled surface of the mid-portion prior to application on the sheet structure end.

37. A method according to claim 36, wherein the heat of the molten thermoplastics material causes the at least softening of the profiled surface.

38. A method according to claim 36 or claim 37, wherein the molten thermoplastics material is applied substantially immediately before the mid-portion is applied onto the sheet structure end.

39. A method according to any of claims 32 to 38, wherein the tape is applied to the sheet structure with the latter inclined from the horizontal.

40. A method according to any of claims 32 to 39, wherein, following application of the mid-portion onto the structure end, the side portions are mounted on the side walls of the sheet structure.

41. A method according to any of claims 32 to 40, wherein a molten thermoplastics material is applied onto the sides of the sheet structure adjacent the end thereof, such that the thermoplastics material overlaps onto the rear of the mid-portion.

42. A method according to any of claims 32 to 41, wherein the side portions are mounted by at least softening, and preferably melting, thermoplastics material provided thereon.

43. A method according to claim 42, wherein heat is applied to the respective parts of the backing layer.

44. A method according to any of claims 32 to 41, wherein the side portions are mounted by providing silicone thereon, which may be transparent and/or may be applied as a bead of material to bond to the sheet structure.

45. A method according to claim 44, wherein heat is applied to accelerate cure of the silicone.

46. A method according to any of claims 32 to 45, wherein the tape is folded or creased between the mid-portion and side portions prior to application onto the sheet structure end.

47. A method according to any of claims 32 to 46, wherein the side portions are urged onto the side walls of the sheet structure by rollers.

48. A tape for sealing an open end of a multiwall sheet structure substantially as hereinbefore described with reference to Figs. 1 to 6, 7 to 9, 10 and 11, 12 to 14, 15 and 16 of the accompanying drawings.

49. A method of forming a tape substantially as hereinbefore described with reference to Figs. 1 to 6, 7 to 9, 10 and 11, 12 to 14, 15 and 16 of the accompanying drawings.

50. A method of sealing an open end of a multiwall sheet structure substantially as hereinbefore described with reference to Figs. 1 to 6, 7 to 9, 10 and 11, 12 to 14, 15 and 16 of the accompanying drawings.

51. Any novel subject matter or combination including novel subject matter disclosed herein, whether or not within the scope of or relating to the same invention as any of the preceding claims.

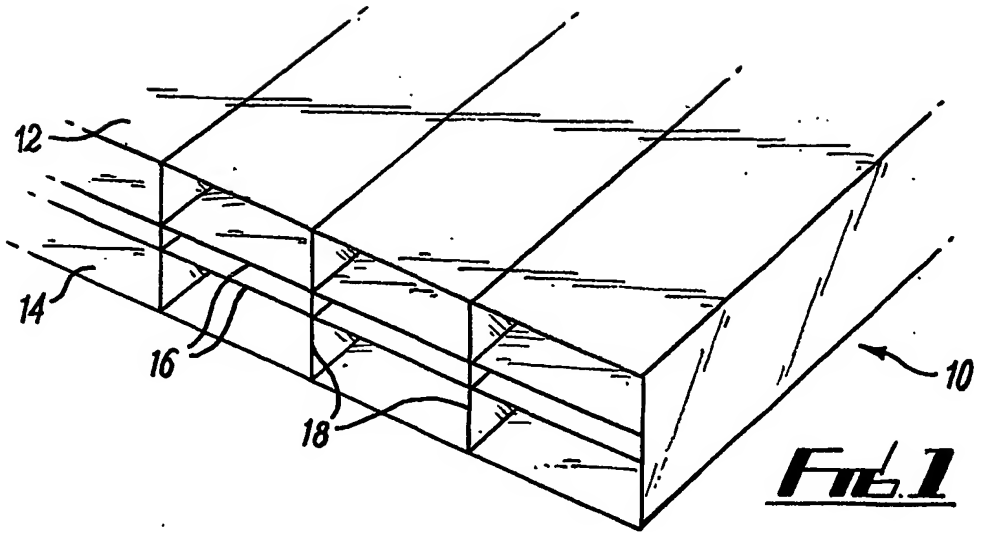


FIG. 1

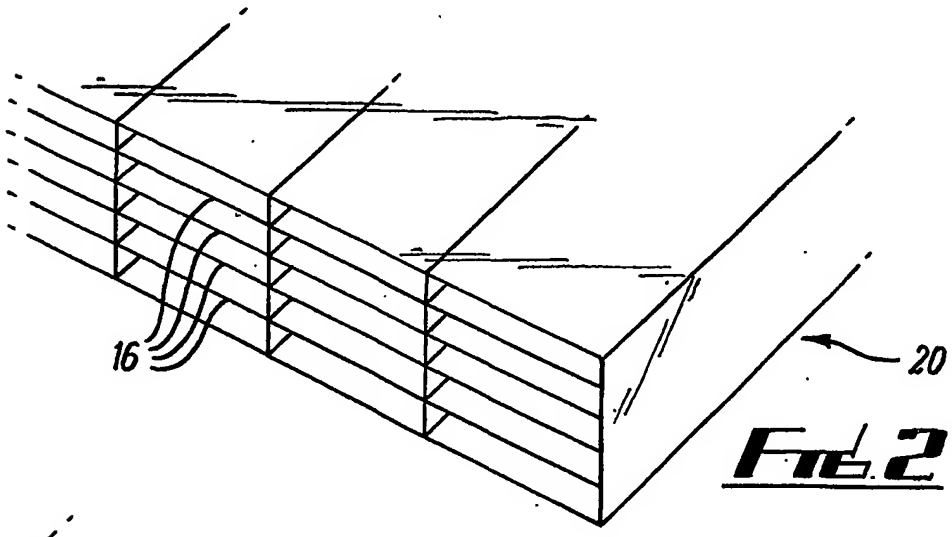


FIG. 2

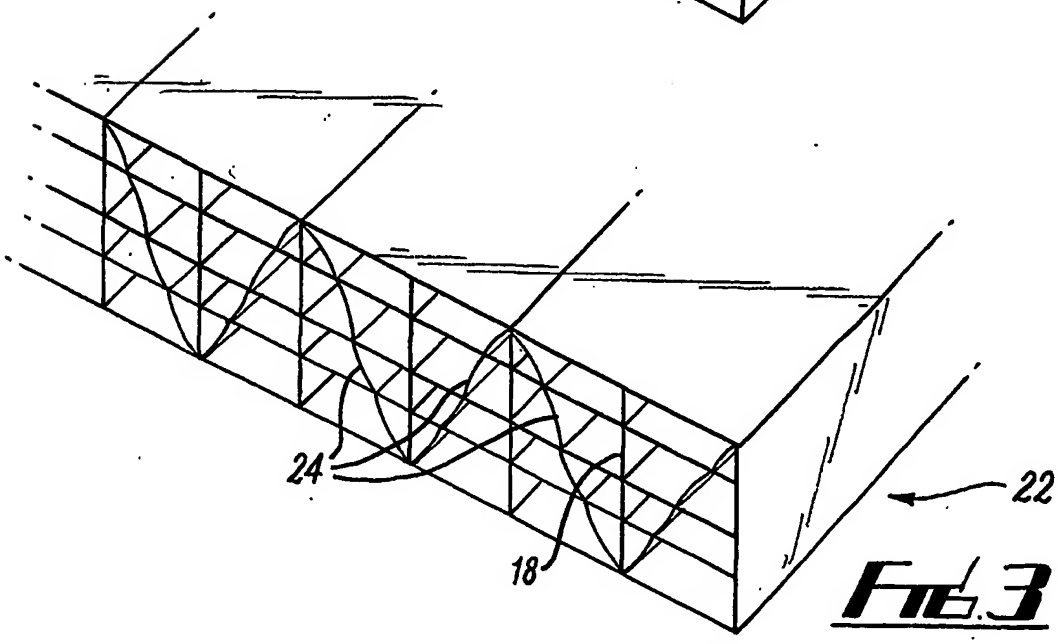


FIG. 3

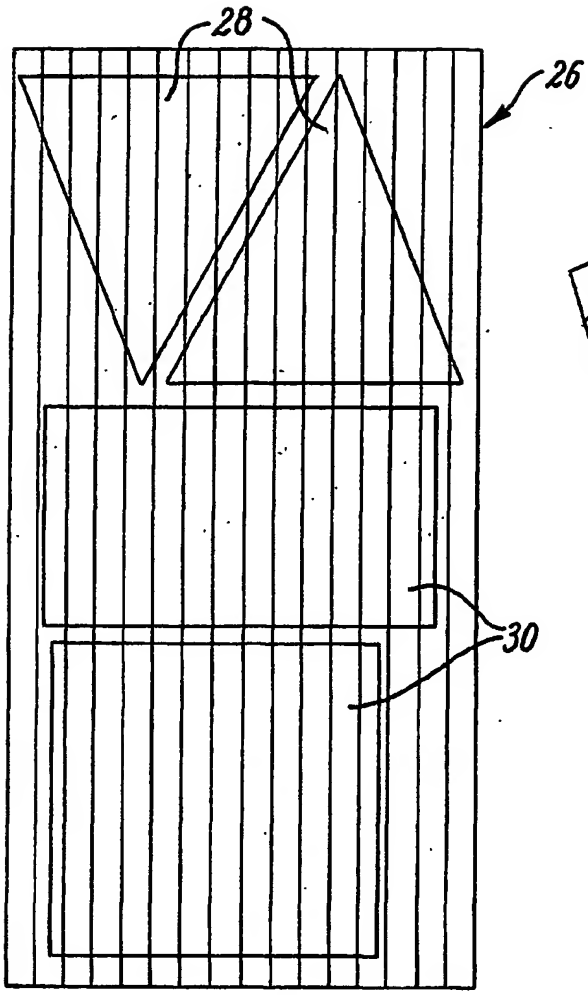


FIG. 4

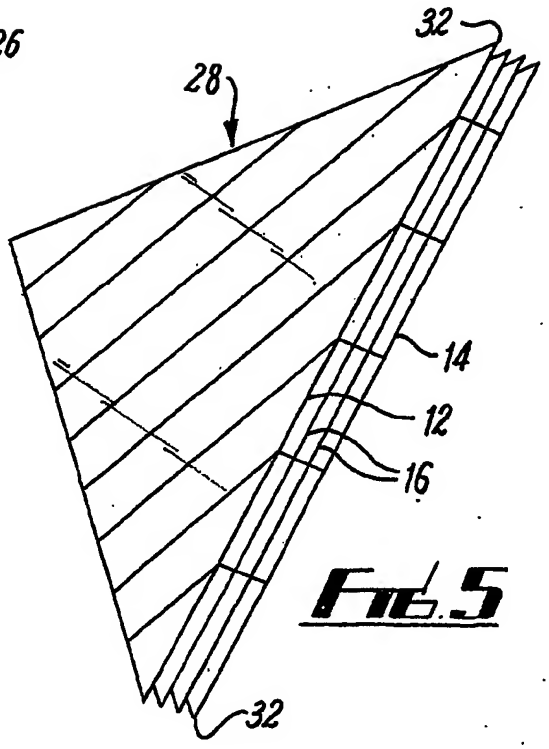


FIG. 5

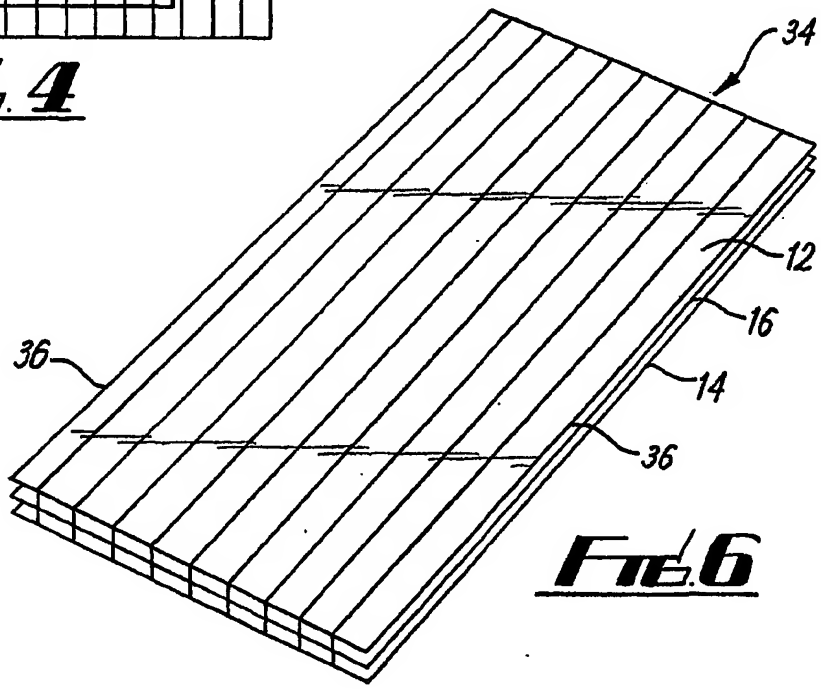
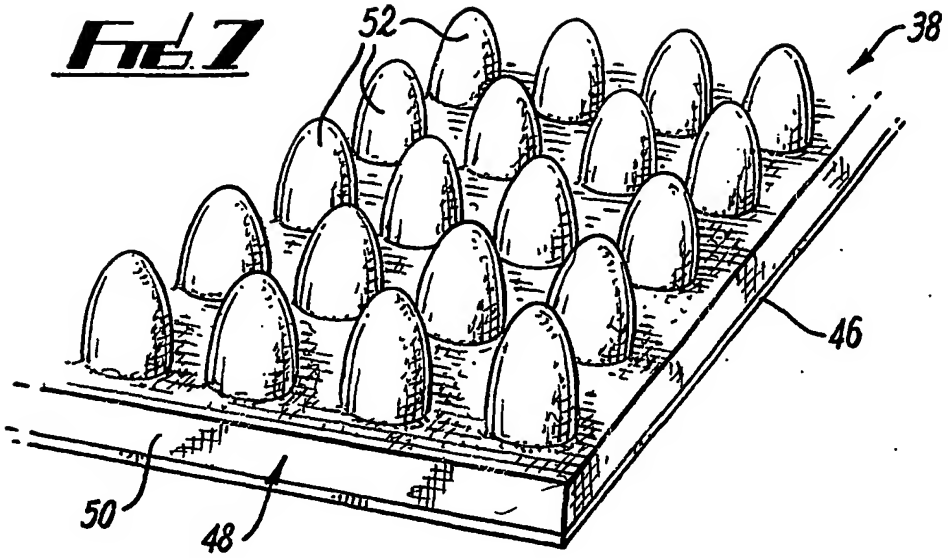


FIG. 6

FIG. 7



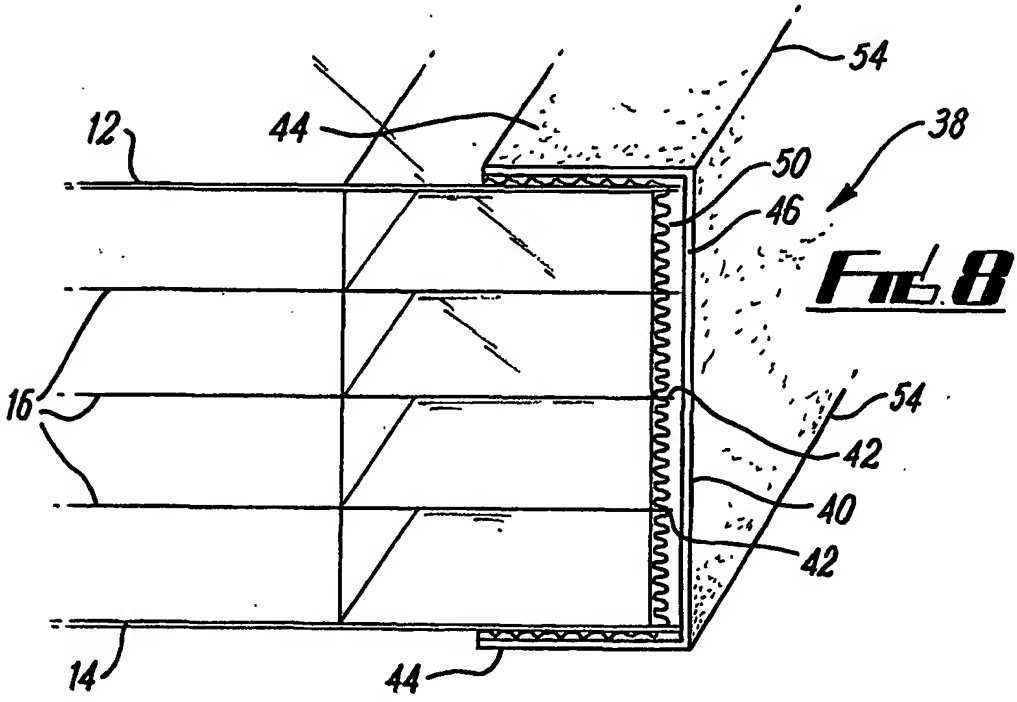
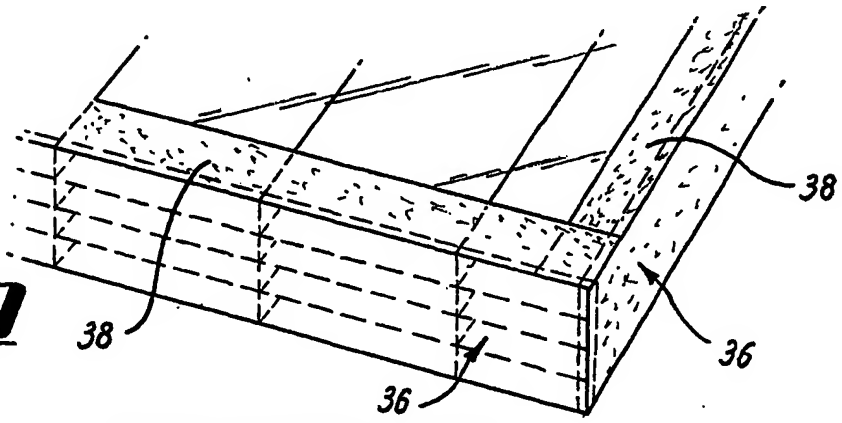


FIG. 8

FIG. 9



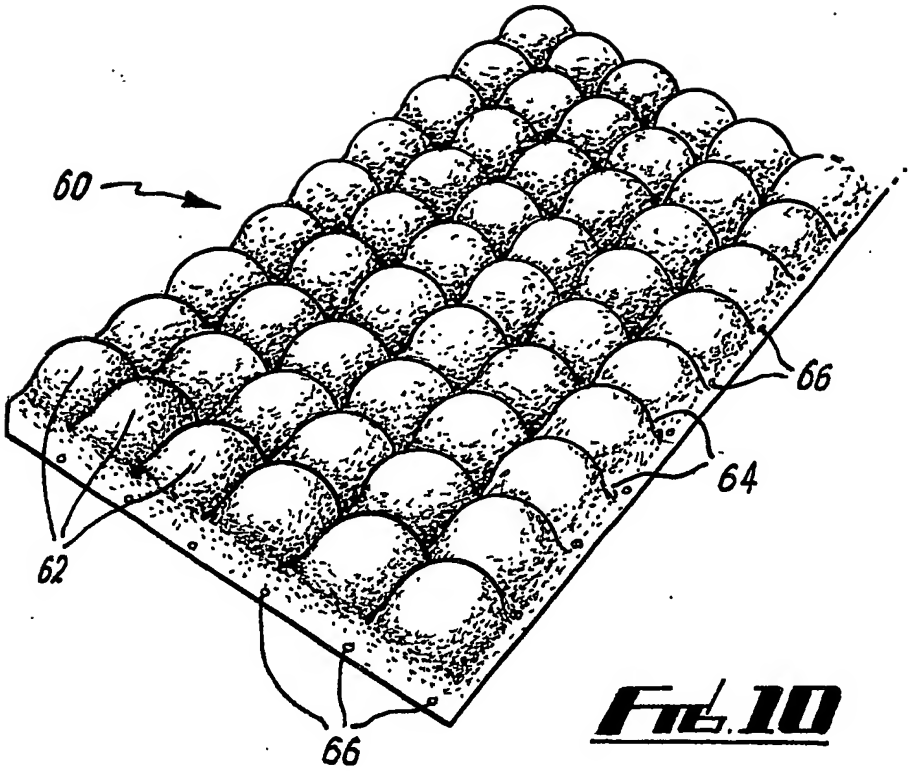


Fig. 10

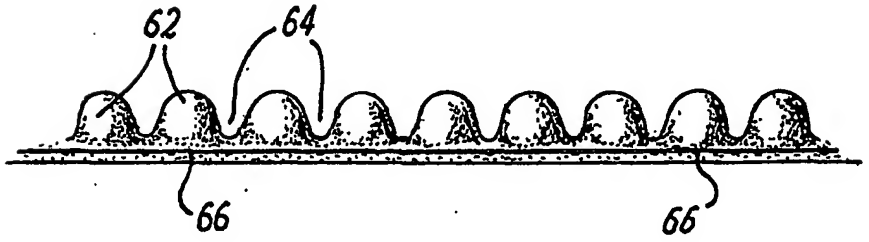


Fig 11

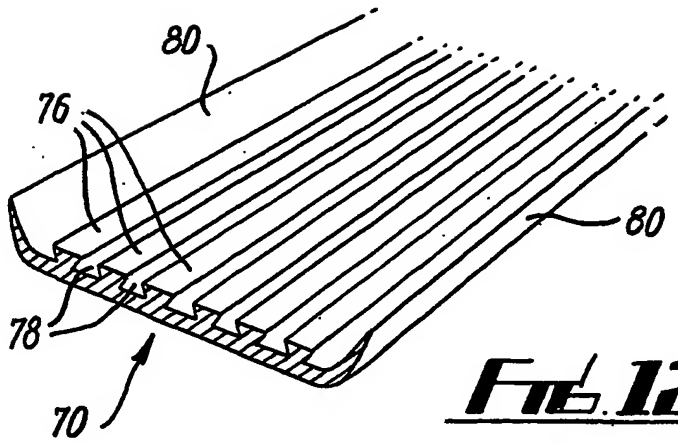


FIG. 12

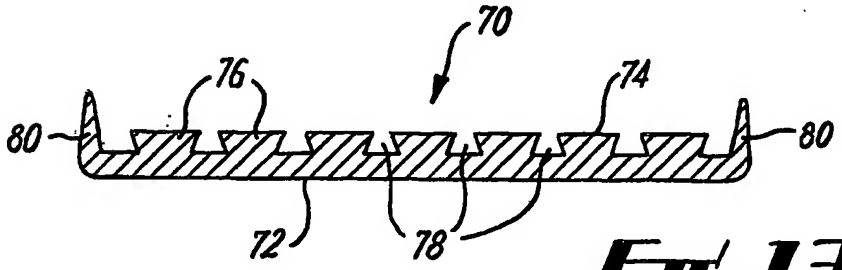


FIG. 13

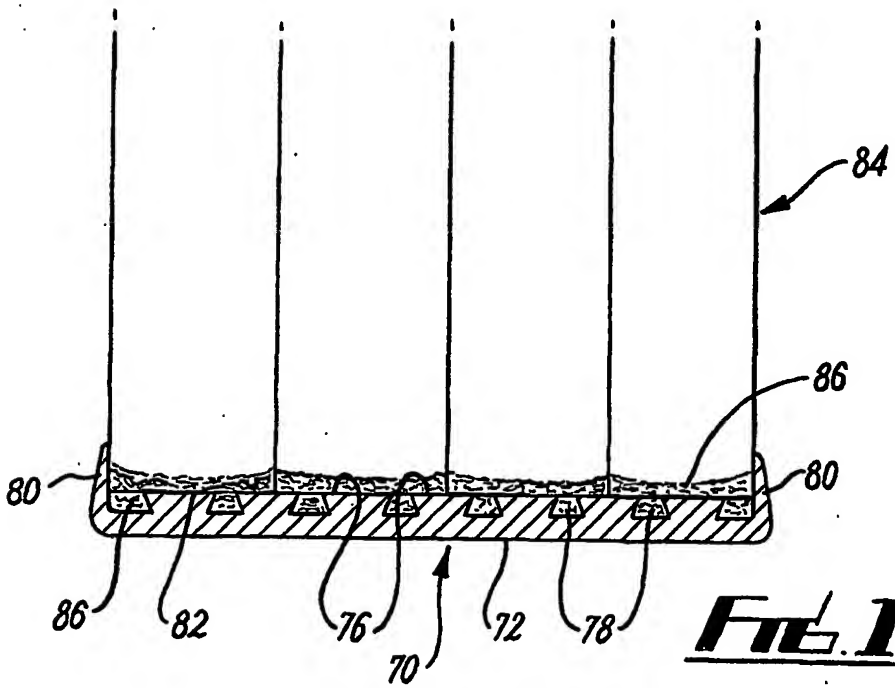


FIG. 14

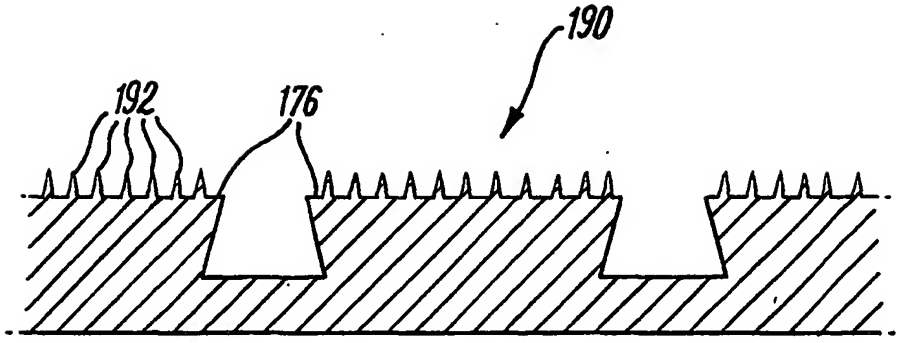


FIG. 15

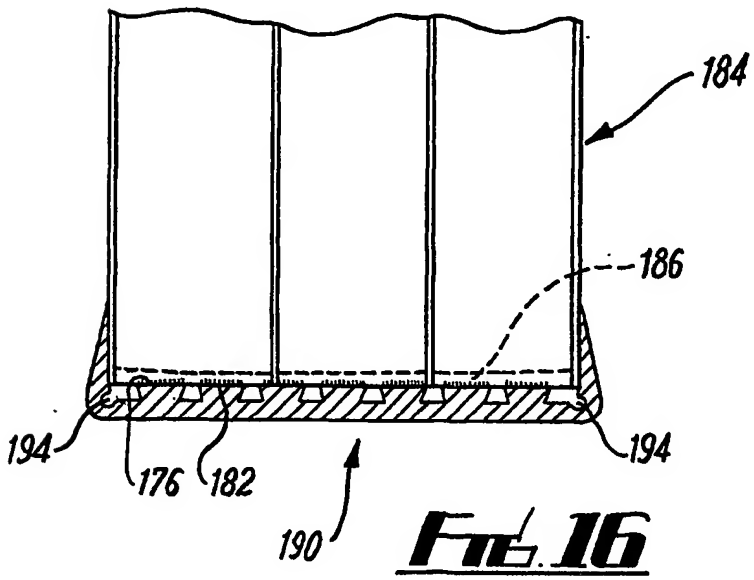


FIG. 16

INTERNATIONAL SEARCH REPORT

Inte- nal Application No
PC1/GB 01/04802

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04C2/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 920 899 A (RHODES ET AL.) 9 June 1999 (1999-06-09) column 2, line 52 -column 3, line 42; figures 1-3	1,27,32, 48-50

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search	Date of mailing of the international search report
28 January 2002	04/02/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Mysliwetz, W

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INTERNATIONAL SEARCH REPORT

ormation on patent family members

In onal Application No
PCT/GB 01/04802

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 920899 A	09-06-1999	EP 0920899 A1	09-06-1999

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